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Dual Purge Manifold

Field of the Invention

This invention relates to electrostatically-aided coating methods and apparatus.

Background of the Invention

Various methods and apparatus for coupling a coating material dispensing device which is maintained at high-magnitude electrostatic potential to a manifold through which various types, for example, colors, of coating material and other services, such as solvent(s), and purging and drying gases, such as compressed air, are known. There are, for example, the devices illustrated and described in U. S. Patents: 3,674,205; 4,422,576; 4,487,367; 4,508,266; 4,728,034; 5,725,150; 5,787,928; 6,010,084; 6,196,478; and, 6,423,143.

Additionally, many voltage blocks are illustrated and described in the prior art. There are, for example, the voltage blocks illustrated and described in U.S. Pat. Nos. 6,423,143; 5,944,045; 5,787,928; 5,746,831; 5,725,150; 5,632,816; 4,878,622; 4,982,903; 5,033,942; 5,154,357; and 5,193,750, and the references cited in those patents, particularly including U.S. Pat. Nos. 1,655,262; 2,547,440; 2,673,232; 3,098,890; 3,122,320; 3,291,889; 3,893,620; 3,933,285; 3,934,055; 4,017,029; 4,020,866; 4,085,892; 4,275,834; 4,313,475; 4,383,644; and, 4,413,788, and U.K. Patent Specifications 1,393,333 and 1,478,853. Also of interest are U.S. Pat. Nos. 2,814,551; 3,838,946; 4,030,860; 4,232,055; 4,381,180; 4,386,888; 4,515,516; 4,741,673; 4,792,092; 4,879,137; 4,881,688; 4,884,745; 4,932,589; 4,962,724; 5,078,168; 5,096,126; 5,102,045; 5,102,046; 5,197,676; 5,249,748; and, 5,255,856.

The disclosures of these references are hereby incorporated herein by reference. This listing is not intended to be a representation that a complete search of all relevant art has been made, or that no more pertinent art than that listed exists, or that the listed art is material to patentability. Nor should any such representation be inferred.

Disclosure of the Invention

According to an aspect of the invention, a coating material dispensing system includes a coating dispenser, a high-magnitude potential supply to provide charge to the

dispenser, supply valves and a first purge valve. The supply valves have respective input ports, respective output ports, and respective control ports. The first purge valve has an input port, an output port and a control port. A conduit couples the output port of a first one of the supply valves to a common point in a fluid circuit. A conduit couples the output port of a second one of the supply valves to the common point. A conduit couples the output port of the first purge valve to the common point. A conduit couples the common point to the coating dispenser to provide fluid from one of: the output port of said first one of the supply valves; the output port of said second one of the supply valves; and the output port of the first purge valve, to the coating dispenser. The common point is coupled to ground.

Illustratively according to this aspect of the invention, the circuit includes two manifolds, each including a valve for each different type of coating material to be dispensed through that respective manifold. Each manifold includes an output port coupled to an input port of a respective one of the supply valves.

Further illustratively according to this aspect of the invention, the circuit includes second purge valves. The second purge valves have respective input ports, respective output ports, and respective control ports. The circuit further includes a container for receiving fluid purged from the circuit. The circuit also includes two manifolds, each including a valve for each different type of coating material to be dispensed through that respective manifold. Each manifold includes an output port coupled to an input port of a respective one of the second purge valves. An output port of each of the second purge valves is coupled to the container for receiving fluid purged from the circuit.

According to another aspect of the invention, a coating material dispensing system includes a coating dispenser having a terminal for coupling to a high-magnitude potential supply for providing electrical charge to the coating material as the coating material is dispensed by the dispenser. The system further includes supply valves and a purge valve. The supply valves have respective input ports, respective output ports, and respective control ports. The purge valve has an input port, an output port and a control port. Means are provided for coupling the output port of a first one of the supply valves to a common point in a fluid circuit; for coupling the output port of a second one of the supply valves to the common point; for coupling the output port of the purge valve to the common point; and, for coupling the common point to the coating dispenser. The common point is coupled to ground.

Illustratively according to this aspect of the invention, the means for coupling:

the output port of a first one of the supply valves to a common point in the circuit; the output port of a second one of the supply valves to the common point; the output port of the second purge valve to the common point; and, for coupling the common point to the coating dispenser comprises: a conduit for coupling the output port of the first one of the supply valves to the common point in the circuit; a conduit for coupling the output port of the second one of the supply valves to the common point; a conduit for coupling the output port of the second purge valve to the common point; and, a conduit for coupling the common point to the coating dispenser.

Additionally illustratively according to this aspect of the invention, the circuit includes two manifolds. Each manifold includes a valve for each different type of coating material to be dispensed through that respective manifold. Each manifold includes an output port coupled to an input port of a respective one of the supply valves.

Illustratively according to this aspect of the invention, the circuit includes a container for receiving fluid purged from the circuit. The circuit includes two manifolds. Each of the two manifolds includes a valve for each different type of coating material to be dispensed through that respective manifold. Each manifold includes an output port coupled to an input port of a respective one of the first purge valves. An output port of each of the purge valves is coupled to the container for receiving fluid purged from the circuit.

According to another aspect of the invention, a method for dispensing coating material includes coupling a coating dispenser to a high-magnitude potential supply to provide charge to the dispenser, and providing supply valves and a purge valve, each having respective input ports, respective output ports, and respective control ports. The method further includes coupling: the output port of a first one of the supply valves to a common point in a fluid circuit; the output port of a second one of the supply valves to the common point; the output port of the purge valve to the common point; and, the common point to the coating dispenser. The method further includes coupling the common point to ground.

Brief Description of the Drawings

The invention may best be understood by referring to the following detailed description and accompanying drawing which illustrates the invention. The drawing illustrates a schematic diagram of a system incorporating the invention.

Detailed Descriptions of Illustrative Embodiments

The drawing illustrates a dual purge system 10 for an electrostatic coating dispenser 12 of any of the general types illustrated in, for example, U. S. Patents: 3,155,539; 3,169,882; 3,169,883; 4,148,932; 4,275,838; 4,381,079; 4,447,008; and, DeVilbiss Ransburg AEROBELL® type 33 liquid rotary atomizer available from ITW Ransburg Electrostatic Systems, 320 Phillips Avenue, Toledo, Ohio 43612. The dispenser 12 is coupled to a high-magnitude voltage output terminal of a high-magnitude potential supply 14 to impart charge to particles of coating material dispensed by the dispenser 12 to facilitate the deposit of the thus-charged particles on an article 18 to be coated by the particles, all in accordance with known principles.

The coating material to be dispensed is supplied through two parallel circuits 20-1, 20-2 from one, two or more coating material supplies. Where more than two supplies are present, each circuit 20-1, 20-2 may be coupled to an output port 21-1, 21-2 of a respective manifold 22-1, 22-2 which is supplied with multiple coating material types, for example, multiple colors. The color to be dispensed at any given time is selected by actuating that color's respective valve 24-1-1, 24-1-2, . . . 24-1-(m - 1), 24-1-m, 24-2-1, 24-2-2, . . . 24-2-(n - 1), 24-2-n on a respective one of the manifolds 22-1, 22-2. Other valves 25-1, 25-2 on each of manifolds 22-1 and 22-2 supply solvent and a drying agent, for example, compressed air, to the manifolds 22-1 and 22-2 to flush and dry the manifolds 22-1, 22-2 between dispensing one color and dispensing the next color.

Conduits 26-1, 26-2 couple the respective supplies 21-1, 21-2 to input ports 28-1, 28-2 of respective trigger valves 30-1 and 30-2 and to input ports 32-1 and 32-2 of respective dump valves 34-1 and 34-2. Output ports 36-1 and 36-2 of the respective trigger valves 30-1 and 30-2 are coupled through respective conduits 50-1, 50-2 to a common conduit 40 which is coupled to dispenser 12 to supply the selected coating material to it. The input ports 28-1, 28-2 of trigger valves 30-1, 30-2, respectively, are coupled to their respective output ports 36-1, 36-2 when a signal of, for example, compressed air is applied at their respective pilot input ports 39-1, 39-2. Input ports 32-1, 32-2 of dump valves 34-1, 34-2, respectively, are coupled to their respective output ports 41-1, 41-2 when a signal of, for example, compressed air is applied at their respective pilot input ports 43-1, 43-2. Output ports 41-1, 41-2 are coupled through a common dump conduit 45 to a refuse container.

A solvent trigger valve 42 includes an input port 44 which is coupled to an appropriate source 46 of solvent. An output port 48 of solvent trigger valve 42 is coupled to

common conduit 40. The presence or absence of a signal of, for example, compressed air, applied to pilot input port 49 controls the state of valve 42, that is, whether its input port 44 is coupled to its output port 48 or whether its input and output ports 44, 48, respectively, are isolated from one another.

The lengths of conduit 50-1, 50-2 and 50-3 which couple output ports 36-1, 36-2 and 48 to conduit 40 are coupled together at an electrically non-insulative fitting 52 which is coupled to ground. This helps to maintain valves 30-1, 30-2, 42 at ground. Although not so illustrated, the manifolds 22-1, 22-2 and their valves 24-1-1, 24-1-2, . . . 24-1-(m - 1), 24-1-m, 24-2-1, 24-2-2, . . . 24-2-(n - 1), 24-2-n, and valves 30-1, 30-2, 34-1, 34-2, 42 are also typically coupled to, and maintained at or near, ground potential. This aids in purging of one circuit 20-1 or 20-2 while coating material is being delivered through the other circuit 20-2 or 20-1, respectively, to be dispensed by dispenser 12. Conduit 40 illustratively is a coiled tube of sufficient length to stand off the high magnitude potential established by supply 14 on dispenser 12 sufficiently from the ground at fitting 52 to permit electrostatically-aided dispensing. The lengths of conduit 50-1, 50-2 and 50-3 are kept as short as feasible to minimize the fluid content of these lengths of conduit 50-1, 50-2 and 50-3.

This arrangement permits faster color change, since the only components that require cleaning to change colors are conduit 40 and the dispenser 12. All remaining components of a respective circuit 20-1 or 20-2 can be cleaned off line, that is, while coating material is being dispensed from the other circuit 20-2 or 20-1, respectively. Further, since the system includes an inline solvent valve 42, clean purge solvent is present at fitting 52, which permits color change to be executed faster, resulting in increased throughput in a coating operation.